

WHAT IS CLAIMED IS:

263. An LED-based planar light illumination (PLIM) chip for use in a PLIIM-based system, comprising:

5 a semiconductor substrate supporting a linear-type light emitting diode (LED) array including an array of LEDs, each having a light emitting source;

a focusing-type microlens array having an array of focusing lenslets aligned in spatial registration with said array of LEDs;

10 a collimating type microlens array having an array of collimating lenslets aligned in spatial registration with said array of LEDs and said array of focusing lenslets;

an IC package having a light transmission window, for containing said semiconductor substrate, said focusing-type microlens array, and said collimating-type microlens array,

wherein each focusing lenslet focuses a reduced-size image of the light emitting source of an LED in said LED array, towards a focal point above said focusing-type microlens array;

5 wherein each collimating lenslet collimates the light rays associated with the reduced size image of the corresponding light emitting source; and

wherein each cylindrical lenslet diverges the collimated light beam so as to produce a spatially-coherent planar light illumination beam (PLIB) component, which collectively produce a composite PLIB from the LED-based PLIM.

264. An LED-based PLIM chip for use in a PLIIM-based system having a relatively short working distance, comprising: a linear-type light emitting diode (LED) array (A), a focusing-type microlens array (B), collimating type microlens array (C), and a cylindrical-type microlens array (D), wherein each are mounted within the IC package of the PLIM chip, for use in object illumination producing a spatially-incoherent planar light illumination beam (PLIB) therefrom.

265. An optical process carried within the LED-based PLIM, wherein (1) the focusing lens element focuses a reduced-size image of the light emitting source of the LED towards a focal point within the barrel structure, (2) the collimating lens element collimates the light rays associated with the reduced-size image of the light emitting source, and (3) the cylindrical lens element diverges (i.e. spreads) the collimated light beam so as to produce a spatially-incoherent planar light illumination beam (PLIB).

266. An optical process carried within the LED-based PLIM, wherein (1) each focusing lenslet focuses a reduced-size image of a light emitting source of an LED towards a focal point above the focusing-type microlens array, (2) each collimating lenslet collimates the light rays

associated with the reduced-size image of the light emitting source, and (3) each cylindrical lenslet diverges the collimated light beam so as to produce a spatially-incoherent planar light illumination beam (PLIB) component, which collectively produce a composite spatially-incoherent PLIB from the LED-based PLIM.

267. A LED-based PLIM is realized as an array of components, contained within a miniature IC package, namely:

- a linear-type light emitting diode (LED) array, on a semiconductor substrate, providing a linear array of light emitting sources (having the narrowest size and dimension possible);

- a focusing-type microlens array, mounted above and in spatial registration with the LED array, providing a focusing-type lenslet above and in registration with each light emitting source, and projecting a reduced image of the light emitting source at its focal point above the LED array;

- a collimating-type microlens array, mounted above and in spatial registration with the focusing-type microlens array, providing each focusing lenslet with a collimating-type lenslet for collimating the light rays associated with the reduced image of each light emitting device;

- a cylindrical-type microlens array, mounted above and in spatial registration with the collimating-type micro-lens array, providing each collimating lenslet with a linear-diverging type lenslet for producing a spatially-incoherent planar light illumination beam (PLIB) component from each light emitting source; and

- an IC package containing the above-described components in the stacked order described above, and having a light transmission window through which the spatially-incoherent PLIB is transmitted towards the target object being illuminated.

268. A LED-based PLIM realized within an IC package design comprising:

- a light emitting diode (LED) providing a light emitting source (having the narrowest size and dimension possible) on a semiconductor substrate;

- focusing lenslet, mounted above and in spatial registration with the light emitting source, for projecting a reduced image of the light emitting source at its focal point, which is preferably set by the further working distance required by the application at hand;

- a cylindrical-type microlens, mounted above and in spatial registration with the collimating-type microlens, for producing a spatially-incoherent planar light illumination beam (PLIB) from the light emitting source; and

- an IC package containing the above-described components in the stacked order described above, and having a light transmission window through which the composite spatially-incoherent PLIB is transmitted towards the target object being illuminated.

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